CLAIMS

1. Method for quantifying the performance of a component (1) adapted to function as a node in a communications network, where the service time delay (S) for an information unit (A) with a certain payload (P) is known as the time difference between the time of departure (t_d) of said information unit (A) and the time of arrival (t_a) of said information unit (A), where a first service time (S_1) is known for a first information unit (A_1) with a first payload (P_1), a second service time (S_2) is known for a second information unit (A_2) with a second payload (P_2), and so on to a last information unit (A_n) with a last payload (P_n) in a stream of payloads, and where the incremental step (IS) of payload between said first, second and following information units (A_1, A_2, .., A_n) is predefined, **characterized** in, that said component is represented by a virtual distance (x) according to the following formula:

$$x = v_1 \cdot S_1 = v_2 \cdot S_2 = \cdots = v_i \cdot S_i = v_{i+1} \cdot S_{i+1} = \cdots = v_n \cdot S_n$$

that the virtual distance x is a constant distance for a given component, that v_i corresponds to a virtual speed with which an information unit (Ai) with a specific payload P_i travels, that S_i corresponds to the time taken to travel said distance x with the speed v_i, S_i being the service time for an information unit A_i with payload P_i, that the speed v_i is represented by:

$$v_i = \left[\frac{S_{i+1}}{S_i} - 1\right] \cdot IS^{-1}$$

that the constant distance x thus is represented by:

$$x = \frac{S_{i+1} - S_i}{IS}$$

and that the virtual distance x is a representation of a metric that relates to intrinsic properties of said component, allowing said quantification of said component.

2. Method according to Claim 1, **characterised** in, that said component (1) is represented by two distances, that a first distance ${}_{a}x$ represents said component in a first sense, meaning that as said information units arrive to said component (1) through a first interface (1a) and departs from said component (1) through a second interface (1b), such as uplink communication, and that a second distance ${}_{b}x$ represents said component (1) in a second sense, meaning that said information units arrive to said component (1) through said second interface (1b) and departs from said component (1) through said first interface (1a), such as downlink communication.

3. Method according to Claim 1 or 2, **characterised** in, that, if said component (1) has a number of usable interfaces (1a, 1b, ..., 1n), then said component is represented by two distances, meaning two senses, for every possible combination of interfaces.

4. Method according to any preceding Claim, **characterised** in, that said service time (S) is a part of a components total response time (R), that the response time (R) is a sum of said service time (S) and a waiting time (W), that $R_i = t_{di} - t_{ai}$, that if $t_{ai} \geq t_{d(i-1)}$ then $W_i = 0$ and $S_i = R_i$, and that if $t_{ai} < t_{d(i-1)}$ then $W_i = t_{d(i-1)} - t_{ai}$ and $S_i = t_{di} - t_{d(i-1)}$.

5. Method according to any preceding Claim, **characterised** in, that said service time (S) comprises the time to process, to check for errors and to transmit an information unit (A), and that the time to process an information unit (A) may include any management time and other delays relating to network specific details.

6. Method according to any preceding Claim, **characterised** in, that statistical methods are used to obtain values for service times (S), and thus virtual speed (v), representing information units (A) with different payloads (P), and virtual distance (x) representing said component (1), with sufficient accuracy and certainty.

7. System for quantifying the performance of a component (1) adapted to function as a node in a communications network, said system comprising a first,

second and third computing unit, where said first computing unit (2) is connected to said component (1) by means of a first interface (1a), where said second computing unit (3) is connected to said component (1) by means of a second interface (1b), where said first computing unit (2) is adapted to send an information unit (A) with a certain payload (P) to said second computing unit (3) through said component (1), where said third computing unit (4) is adapted to passively calculate the service time delay (S) for said information unit (A) by using the information obtained by measuring the time difference between the time of departure (t_d) of said information unit (A) from said component (1) and the time of arrival (t_a) of said information unit (A) to said component (1), where said first computing unit (2) is adapted to send a stream of information units where the incremental step (IS) of payload between a first, second and following information units (A_1, A_2, ..., A_n) is predefined, where said third computing unit (4) is adapted to measure a first service time (S_1) for a first information unit (A_1) with a first payload (P_1), a second service time (S_2) for a second information unit (A_2) with a second payload (P_2), and so on to a last information unit (A_n) with a last payload (P_n) in said stream of information units, **characterized** in, that said component (1) is represented by a virtual distance x, that said third computing unit (4) is adapted to calculate said virtual distance according to the following formula:

$$x = v_1 \cdot S_1 = v_2 \cdot S_2 = \cdots = v_i \cdot S_i = v_{i+1} \cdot S_{i+1} = \cdots = v_n \cdot S_n$$

that said virtual distance x is a constant distance for a given component (1), that v_i corresponds to a virtual speed with which an information unit (A_i) with a specific payload (P_i) travels, that S_i corresponds to the time taken to travel said distance x with the speed v_i, S_i being the service time for an information unit A_i with payload P_i, that the speed v_i is represented by:

$$v_i = \left[\frac{S_{i+1}}{S_i} - 1\right] \cdot IS^{-1}$$

that the constant distance x thus is represented by:

$$x = \frac{S_{i+1} - S_i}{IS}$$

and that said third computing unit (4) is adapted to present the virtual distance x as a representation of a metric that relates to intrinsic properties of said component (1), thus providing said quantification of said component (1).

8. System according to Claim 7, **characterised** in, that said third computing unit (4) is adapted to calculate two distances representing said component (1), that a first distance $_{a}x$ represents said component (1) in a first sense, where said first computing unit (2) is adapted to send information units to said second computing unit (3) through said component (1), such as uplink communication, and that a second distance $_{b}x$ represents said component (1) in a second sense, where said second computing (3) unit is adapted to send packets to said first computing (2) unit through said component (1), such as downlink communication.

9. System according to Claim 7 or 8, **characterised** in, that, if said component (1) has a number of usable interfaces (1a, 1b, ..., 1n), then said first and second computing units (2, 3) are adapted to communicate with each other through said component (1) through every possible combination of interfaces, and that said third computing unit (4) is adapted to calculate and present two distances representing said component (1), meaning two senses, for every possible combination of interfaces.

10. System according to Claim 7, 8 or 9, **characterised** in, that said third computing unit (4) is adapted to extract said service time (S) from the total response time of said component, where the response time (R) is a sum of said service time (S) and a waiting time (W) of said component, that $R_i = t_{di} - t_{ai}$, that if $t_{ai} \geq t_{d(i-1)}$ then $W_i = 0$ and $S_i = R_i$, and that if $t_{ai} < t_{d(i-1)}$ then $W_i = t_{d(i-1)} - t_{ai}$ and $S_i = t_{di} - t_{d(i-1)}$.

11. System according to any one of Claims 7, 8, 9 or 10, **characterised** in, that said service time (S) comprises the time to process, to check for errors and to

transmit an information unit (A), and that the time to process an information unit (A) may include any management time and other delays relating to network specific details.

12. System according to any one of Claims 7, 8, 9, 10 or 11, **characterised** in, that said first and second computing units (2, 3) are adapted to send and receive several streams of information units through said component (1), each stream being sufficiently long to represent information units (A) with different payloads (P), in order to provide said third computing unit (4) with measurement data required to perform statistical methods to obtain values for service times (S), virtual speed (v) and virtual distance (x) with sufficient accuracy and certainty.

13. A first computer program product, **characterised** in, that said first computer program product comprises first computer program code, which, when executed by a computing unit, makes said computing unit work as a first computing unit according to any one of Claims 7 to 12.

14. A second computer program product, **characterised** in, that said second computer program product comprises second computer program code, which, when executed by a computing unit, makes said computing unit work as a second computing unit according to any one of Claims 7 to 12.

15. A third computer program product, **characterised** in, that said third computer program product comprises third computer program code, which, when executed by a computing unit, makes said computing unit work as a third computing unit according to any one of Claims 7 to 12.

16. A fourth computer program product, **characterised** in, that said fourth computer program product comprises fourth computer program code, which, when executed by a computing unit, makes said computing unit perform the method according to any one of Claims 1 to 6.

17. Single computing unit (6) for quantifying the performance of a component (1) adapted to function as a node in a communications network, **characterised** in,

that said single computing (6) unit is adapted to function as both a first, second and third computing unit (2, 3, 4) according to any one of Claims 7 to 12.

18. Single computing unit (6) according to Claim 17, **characterised** in, that said single computing unit (6) comprises computer program code according to Claim 16.

19. Single computing unit (6) according to Claim 17, **characterised** in, that said single computing (6) unit comprises computer program code according to Claims 13, 14 and 15.